
CHAPTER IV J

Kesterson National Wildlife Refuge Alternative Plans



U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
MID-PACIFIC REGION

CHAPTER IV J

KESTERSON NATIONAL WILDLIFE REFUGE

Kesterson NWR was purchased by Reclamation in 1969 as part of the San Luis Drain Project. Originally, the refuge was to be used as a regulating reservoir for drain water. The refuge consists of 1,280 acres of holding ponds, 1,080 acres of natural marshlands, and 3,290 acres of grassland/vernal pool habitat, totaling 5,900 acres. The holding ponds, which are not included in this report, are managed by Reclamation and the remainder of the refuge is managed by the Service. Kesterson NWR is located 18 miles north of the City of Los Banos and four miles east of Gustine as shown in Figure IV J-1.

A. WATER RESOURCES

The management objectives of the portion of the refuge managed by the Service are to provide habitat for migratory waterfowl and shorebirds, and to maintain habitats and populations of endangered species, native plants, and animals. Management activities are directed at providing marsh food plants through moist soil management practices. Swamp timothy, smartweed, spikerush, and alkali bulrush are the major food producing species. Production of these species requires that spring drawdowns and summer irrigations are conducted in refuge marshes (USBR, 1986a). During the fall, winter, and spring months (October to April), the refuge provides flooded wetlands for loafing, nesting, and feeding waterfowl. Flooded wetlands are available in closed areas to provide sanctuary for waterfowl and in hunting areas to provide hunting opportunities.

At full development, Kesterson NWR would be able to maintain about 1,000 acres of wetland. Food production would be less intensive with swamp timothy and alkali bulrush being the major species managed. This would provide a more open marsh. The eastern side of Kesterson would have some permanent water and thicker stands of cattail and bulrush to partially compensate for the loss of Kesterson Reservoir and to provide nesting habitat for critical species such as the tri-colored blackbird. Fall and winter use would be generally similar to present management, however, periodic flushings are planned to maintain acceptable salt balances.

1. Surface Waters

Kesterson NWR has firm water rights for 3,500 acre-feet of CVP water. Grassland Water District (GWD) supplies firm water from the Delta Mendota Canal to the refuge during September 15 to November 15 via the San Luis and Santa Fe Canals. These canals have a common source and are in fact connected at a point ten miles to the south of the refuge.

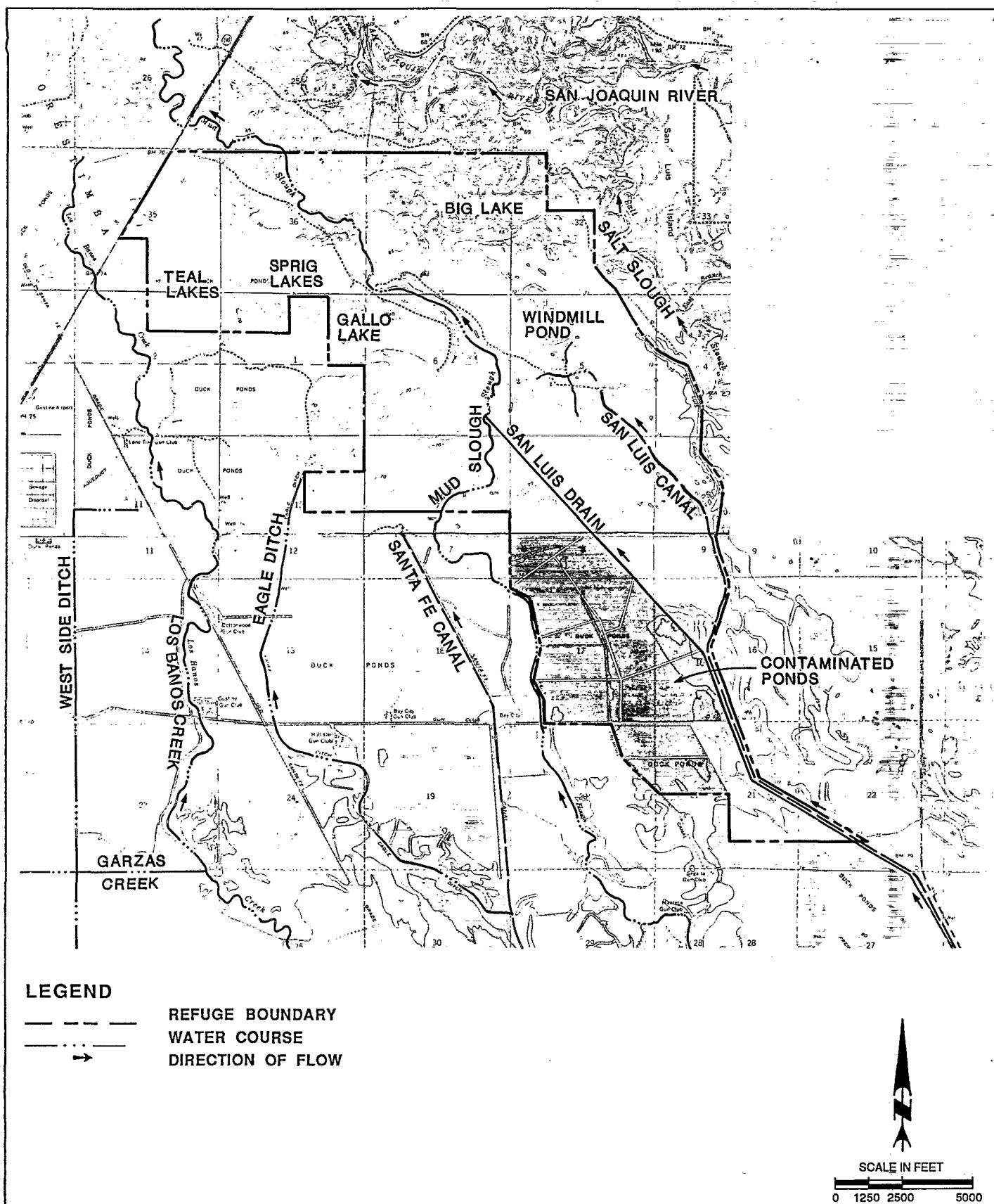


FIGURE IV J-1

KESTERSON NATIONAL WILDLIFE REFUGE

EXISTING WATER SUPPLY FACILITIES

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Drain water is not used for refuge management due to unacceptable levels of selenium. Water supplies delivered to Kesterson NWR are listed in Table IV J-1. As discussed in Chapter IV G of this report, water quality has been a problem at the Kesterson NWR as well as at other refuges in the vicinity. A dependable supply of good quality water must be provided to the refuge to provide for waterfowl utilization.

The estimated annual water requirements and existing water supply for Kesterson NWR are 10,000 acre-feet and 3,500 acre-feet, respectively, as presented in Table IV J-2.

2. Water Conveyance Facilities

Grassland Water District delivers water to Kesterson NWR through the San Luis Canal to the east side of the refuge and through Santa Fe Canal and Eagle Ditch to portions of the west side of the refuge. This high quality CVP water is supplied only on an intermittent basis from the Mendota Pool and the Delta-Mendota Canal.

The Santa Fe Canal does not have capacity restrictions. The Santa Fe Canal, which never enters the refuge, is located at the southwestern end of the refuge and drains into Mud Slough and wetlands outside of Kesterson NWR. The poor quality drain water flowing through Mud Slough is not being used for irrigation or flooding of ponds.

Eagle Ditch, located just outside the west-central side of the refuge, currently is inadequate as a conveyance system because it does not extend to the refuge. Use of Eagle Ditch depends on water delivery through private wetlands within Grassland Resource Conservation District (GRCD). The San Luis Canal extends into the east-central section of the refuge. Its capacity is limited to 20 cfs at this point. The San Luis Drain terminates in the central area of the refuge at Mud Slough. This drain is currently not utilized due to the selenium contamination described previously.

Conveyance system problems within the Kesterson NWR are directly related to problems with supplying water to the refuge boundaries. For example, there is no adequate means of delivering water from the Santa Fe Canal through Eagle Ditch to the northwest portion the refuge.

Refuge areas on the eastern side are dependent upon supplies from the San Luis Canal. Alternative water supplies and restrictive control structures are the primary problems. Construction of new control structures and cleaning and reshaping of The San Luis Canal are needed to assure adequate water delivery capacities.

TABLE IV J-1
WATER DELIVERIES
KESTERSON NWR
(acre-feet)

Year	Total
1977	Data Not Available
1978	7,848 (a)
1979	7,000 (a)
1980	7,300 (a)
1981	4,500 (b)
1982	4,500 (b)
1983	4,200 (b)
1984	4,000 (b)
1985	3,500 (c)

(a) Waste used to manage marsh units plus the Kesterson reservoir.

(b) Water used for fall flooding of all managed marsh units and partial summer irrigations.

(c) Marsh units west of Mud Slough fall flooded then partially summer irrigated.

Sources: USBR, 1986a; USFWS, 1986h

TABLE IV J-2
DEPENDABLE WATER SUPPLY NEEDS
ALTERNATIVE SUPPLY LEVELS FOR THE KESTERSON NWR

Month	Supply Level 1		Supply Level 2		Supply Level 3		Supply Level 4	
	ac-ft	cfs	ac-ft	cfs	ac-ft	cfs	ac-ft	cfs
January	0	0.0	0	0.0	500	8.1	500	8.1
February	0	0.0	0	0.0	500	9.0	500	9.0
March	0	0.0	0	0.0	750	12.2	750	12.2
April	0	0.0	0	0.0	1,000	16.8	1,000	16.8
May	0	0.0	0	0.0	1,000	16.3	1,000	16.3
June	0	0.0	0	0.0	600	10.1	600	10.1
July	0	0.0	0	0.0	600	9.8	600	9.8
August	0	0.0	0	0.0	800	13.0	800	13.0
September	500	8.4	500	8.4	1,000	16.8	1,000	16.8
October	1,500	24.4	1,500	24.4	1,500	24.4	1,500	24.4
November	1,500	25.2	1,500	25.2	1,000	16.8	1,000	16.8
December	0	0.0	0	0.0	750	12.2	750	12.2
Total	3,500	58.0	3,500	58.0	10,000	165.5	10,000	165.5
Maximum	1,500	25.2	1,500	25.2	1,500	24.4	1,500	24.2

Notes:

- Alternative 1 Existing firm water supply
- Alternative 2 Current average annual water deliveries
- Alternative 3 Full use of existing development
- Alternative 4 Optimum management

Source: USFWS, 1986

3. Groundwater

Groundwater levels are generally within 25 feet of the land surface and experience small seasonal fluctuations. Kesterson NWR has similar geologic conditions as the Grassland Water District, as described in Chapter IV G of this report. Please refer to that section for information pertaining to the general groundwater conditions.

One well has been reactivated and provides water to a portion of the east side of the refuge. The reactivated well produces nine acre-feet of water per day. Reclamation estimates that a safe yield of 11,900 acre-feet per year is available for refuge use. The well produces water with a fairly high salt content, thus periodic dilution with high quality, low salt water must be accomplished.

B. FORMULATION AND EVALUATION OF ALTERNATIVE PLANS

For the purposes of assessing the impacts of water delivery alternatives, four levels of water supply have been identified and are presented in Table IV J-2. Each of the water supply levels provide a different rate and volume of water summarized as follows:

- Level 1 - Existing firm water supply
- Level 2 - Current average annual water deliveries
- Level 3 - Water supply needed for full use of existing development
- Level 4 - Water delivery needed for optimum management

Multi-objective project evaluation procedures, in accordance with concepts outlined by the Water Resources Council, is one of the tools used in evaluating and comparing alternatives. The Water Contracting EIS's will evaluate the national, regional, and site-specific environmental impacts of providing water to the refuges and other users under the different water supply levels. Based on the results of the Water Contracting EIS's, water supply levels will be identified for each refuge. Following completion of the Water contracting EIS's, the plans to meet the identified water level will be compared under the National Economic Development Account, Environmental Quality Account, and Social Account.

The beneficial and adverse effects of each alternative to provide additional water to the refuge also were compared with respect to many criteria. A summary comparison of the alternatives to provide additional water to the refuge for Water Supply Levels 1, 2, 3, and 4 is presented in Table IV J-3.

IV J-3

TABLE IV J-3
SUMMARY COMPARISON OF WATER DELIVERY ALTERNATIVES
KESTERSON NWR

	Supply Levels 1 & 2				Supply Level 3	Supply Level 4	
	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E	Alternative F	Alternative G
Availability of Water Supply	Yes	Yes	Yes	Yes	Maybe	Yes	Yes
Ability to Convey Water	Yes	Most of the Year	Yes	Yes	Yes	Most of the Year	Yes
Need New Water	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Need New Conveyance Agreements	Yes	Yes	Yes	Yes	Yes	Yes	No
Type of Water Supply	Fresh Water	Ag. Return Flows and Fresh Water	Ag. Return Flows and Fresh Water	Ag. Return Flows and Fresh Water	Fresh Water	Ag. Return Flows and Fresh Water	Fresh Water & Groundwater
Operational Flexibility	Good	Some	Some	Unknown	Unknown	Unknown	Good
Wildlife Habitat	Improve	Improve	Improve	Improve	Unknown	Improve	Improve
Public Use	Increase	Increase	Increase	Increase	Increase	Increase	Increase
Total Annual Costs \$(a)	98,550	12,590	9,220	22,790	32,210	3,890	166,610

Notes: Alternative A: Zahm-Sansoni Plan
 Alternative B: Extension of Eagle Ditch
 Alternative C: Extension of West Side Ditch to Eagle Ditch
 Alternative D: Main Canal Water via Garzas Creek and Los Banos Creek
 Alternative E: Mud Slough Conveyance
 Alternative F: Extension of Santa Fe Canal
 Alternative G: Conjunctive Use Plan

(a) Total Annual Costs includes annualized construction cost, annual operation and maintenance cost, annual power and wheelage cost.

The following delivery alternatives have been developed to convey the identified levels of water supply described above, and shown on Figure IV J-2.

1. Delivery Alternative for Level 1 (No Action Alternative)

Since this level represents the existing firm water supply, minimum construction and/or the use of existing facilities is required to provide a dependable conveyance system for the refuge. Existing food production is limited to swamp timothy. The only permanent water is in Mud Slough which currently contains drainage water. Flooding durations are short, generally during October to March.

Alternative A - Convey Water Under the Zahm-Sansoni Plan. The Zahm-Sansoni plan is based on usage of the San Luis Drain as a conduit to deliver fresh water to the GRCD. This plan has been described in more detail in Chapter IV G of this report. Water would be delivered to the Kesterson refuge through the Santa Fe and the San Luis Canals. For maximum water delivery efficiency, the existing terminals of the Santa Fe Canal will require rehabilitation, including extension, reshaping, and weir replacement or rehabilitation.

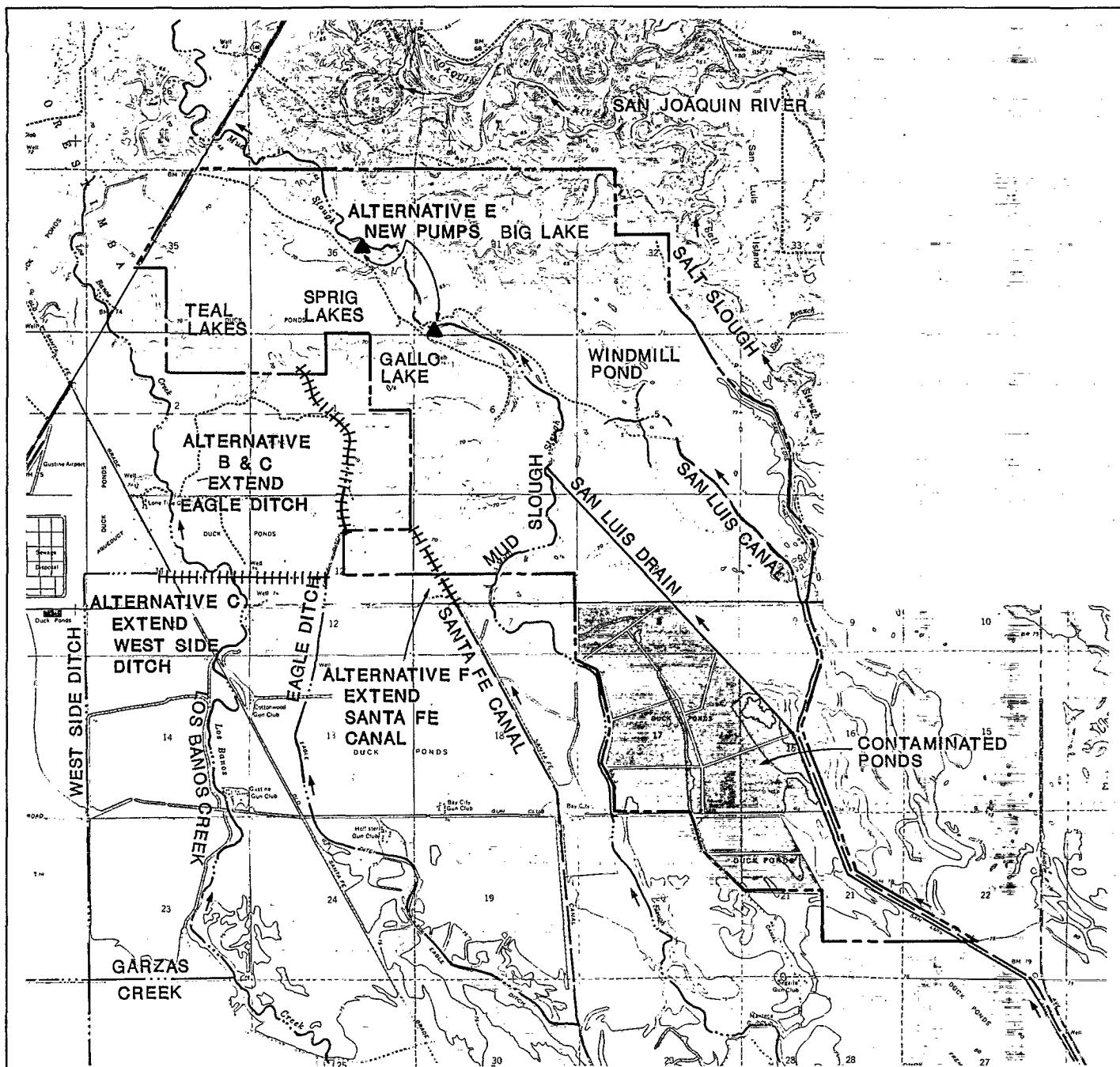
Alternative B - Extend Eagle Ditch into Refuge. Eagle Ditch, which receives water from the Santa Fe Canal, could be extended north to Teal and Sprig Lakes through the Lone Tree Duck Club. This plan would require 7,600 feet of new ditch, two 3-way control structures, six crossings, and six turnouts.

Alternative C - Extend West Side Ditch to Eagle Ditch. The West Side Ditch receives water from Garza Creek. This water would be transported to Eagle Ditch, which could be extended as described above under Alternative B. The connection between West Side Ditch and Eagle Ditch would require 6,000 feet of additional ditch to be constructed, for a total of 13,600 feet of new ditches.

Alternative D - Convey Water from Garzas Creek to Los Banos Creek. Under this alternative, water from the CCID Main Canal could be routed from Garza Creek, north through Los Banos Creek to the refuge boundary, and into ditches to be constructed to Sprig and Teal Lakes. This would require 6,000 feet of ditches, and possibly a low lift pump station.

2. Delivery Alternative for Level 2

Water Level 2 can be accommodated with the delivery alternatives for Level 1.



LEGEND

- — — — — REFUGE BOUNDARY
- — — — — WATER COURSE
- DIRECTION OF FLOW
- ||||| PROPOSED CONVEYANCE FACILITIES

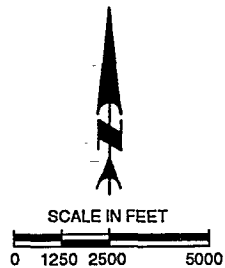


FIGURE IV J-2

KESTERSON NATIONAL WILDLIFE REFUGE
PROPOSED WATER SUPPLY FACILITIES
ALTERNATIVES B, C, E, & F

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3. Delivery Alternative for Level 3

Under this level, construction and/or the use of existing conveyance facilities would be required to fully serve the existing refuge with the increase in water supplied. Permanent water is increased in one pond on the east side of Kesterson NWR to provide habitat for the candidate species, the tri-colored blackbird. An increase in ponded area and irrigation would result in more habitat and food product for bird use.

Alternative E - Utilize Mud Slough. Although Mud Slough waters are currently contaminated, this conveyance system could be utilized in the future if the quality of Mud Slough water improves and selenium levels become acceptable for safe fish and wildlife existence. This is anticipated to occur under Alternative A, The Zahm-Sansoni Plan. However, a source of underground power, low lift pumps, and conveyance system would still be required.

4. Delivery Alternative for Level 4

Under this level, construction and/or the use of existing conveyance facilities would be required to fully serve the already developed areas as well as areas which have not yet been developed within the refuge. Kesterson NWR at full development would be able to maintain about 1,000 acres of intensively managed wetland. Food produced would be less diverse than other refuges with swamp timothy and alkali bulrush being the major species managed. This would provide a more open marsh than other refuges. The eastern side of Kesterson would have some permanent water and thicker stands of cattail and bulrush to partially compensate for the loss of Kesterson Reservoir and to provide nesting habitat for candidate species such as the tri-colored blackbird. Fall and winter use would be generally similar to present management, however, periodic flushings are planned to maintain acceptable salt balances. Alternative E can be utilized to implement Level 5 also.

Alternative F - Extend Santa Fe Canal. Under this alternative, the Santa Fe Canal, which receives water (as described in Chapter II) from the Delta-Mendota Canal, would be extended onto the refuge in the Sprig Lake area. Improvements required include the installation of two weirs, and 2,500 feet of new or rehabilitated ditch.

Alternative G - Implement a Conjunctive Use Plan. Groundwater could be used in conjunction with surface water for meeting Kesterson NWR water supply needs during the drought years. Wells would be required to pump from below the Corcoran Clay for adequate quality. Wells would be located around existing or proposed conveyance facilities.

5. Summary of Alternatives

Alternatives A,B,C, and D are the alternatives for implementation of Levels 1, and 2. As discussed in Chapter IV G of this report, Alternative A, the conveyance of water under the Zahn-Sansoni Plan would benefit this refuge as well as others in the vicinity. Alternative B, C, and D would require long-term conveyance agreements with the SLCC and CCID to transport water, as well as extensive capital costs in extending the canals to the refuge. Due to environmental considerations and ease of implementation, Alternative A is the preferred plan for Levels 1 and 2.

For Level 3, Alternative E requires the implementation of Alternative A, the Zahn-Sansoni Plan. Under Alternative E, Mud Slough would be utilized to transport additional water at a time when the water quality has improved. Alternative E of Level 3 provides for the greatest operational flexibility. Alternatives F and G have been considered to implement Level 4. Alternative F, would require construction and operation of additional facilities. This alternative could be utilized with Alternative A for a better quality water. Alternative G would require higher operation costs than Alternative F due to the depth to an adequate supply of groundwater necessitating higher energy costs.

C. COSTS AND ECONOMIC ANALYSIS

Costs of the alternative plans for providing adequate water supplies under the Water Supply Levels 1,2,3, and 4 are presented in Table IV J-4. and the Cost Estimating Appendix. The construction costs include factors to cover engineering, contingencies, and refuge overhead. During the advanced planning phase, these costs will be refined further.

Construction of the improvements under the selected plan to provide Level 4 water deliveries would result in additional money being spent in Merced County during construction. The construction could be completed within one summer season by construction workers who reside in Merced County.

Currently, the annual public use to Kesterson NWR averages 200 non-consumptive and 2,800 consumptive visitors per year. If the additional water is provided, the attendance levels would increase to 1,000 non-consumptive visitors and 3,900 consumptive visitors per year.

D. WILDLIFE RESOURCES

The annual waterbird use on the Kesterson NWR is approximately 3,759,600 use-days. Approximately 62 and less than one percent of the waterfowl use are by ducks and geese, respectively, including many species which nest on the refuge. Waterbirds comprise 37 percent of the total use-days. The listed threatened

TABLE IV J-4
SUMMARY OF ESTIMATED COSTS OF ALTERNATIVES
KESTERSON NWR

Item	Water Delivery Levels						
	1 & 2				3	3 & 4	
	Alternatives						
	A	B	C	D	E	F	G
Total Construction Costs	\$1,000,000	\$109,000	\$ 79,700	\$135,000	\$125,000	\$21,000	\$371,000
Power Costs (\$/acre-foot)	0.00	0.00	0.00	1.00	1.00	0.00	9.80
Water Wheeling Costs (\$/acre-foot)	0.10	0.10	0.10	1.20	1.20	0.10	0.10
Annualized Construction Costs (8.875%, 30 years)	96,200	10,490	7,670	12,990	12,030	2,020	35,690
Annual Operations and Maintenance Costs	2,000	1,750	1,200	2,100	1,900	870	13,300
Annual Power Costs	0	0	0	3,500	10,000	0	116,620
Annual Water Wheelage Costs	350	350	350	4,200	8,280	1,000	1,000
Total Annual Costs	\$ 98,550	\$ 12,590	\$ 9,220	\$ 22,790	\$ 32,210	\$ 3,890	\$166,610

Alternative A - Convey Water under the Zahm-Sansoni Plan (Siphon Construction)

Alternative B - Extend Eagle Ditch into Refuge

Alternative C - Extend West Side Ditch to Eagle Ditch

Alternative D - Convey Water from Gargas Creek to Los Banos Creek

Alternative E - Utilize Mud Slough

Alternative F - Extend Santa Fe Canal

Alternative G - Conjunctive Use

and endangered species associated with Kesterson NWR are the San Joaquin kit fox, Vulpes macrotis mutica, the bald eagle, Haliaeetus leucocephalus; the American peregrine falcon, Falco peregrinus anatum, Aleutian Canada goose, Branta canadensis leucopareia. Numerous candidate species may occur in this area and are also presented in Table IV J-5.

Kesterson NWR may have the highest populations of the San Joaquin kit fox in the Grassland area. It also has the largest associations of native plants of any San Joaquin refuge. A nesting colony of snowy egrets and black crowned night herons use bulrush in Sprig Lake, one of the deep water marshes. Within the Kesterson Reservoir, extensive cattail stands provide roosting and nesting habitat for tricolored blackbirds. The reservoir was one of the largest breeding areas for waterfowl and shorebirds in the area. It is unusable now because of selenium contamination. Kesterson has one of the best remaining native prairie/vernal pool associations in the area; these vernal pools are the homes of rare plants and are used by waterfowl and resident species.

Implementation of any of alternative plans for Levels 2, 3 and 4 would not adversely effect listed and candidate threatened and endangered species of birds. Detailed field investigations will be necessary during the advanced planning phase of the project. Implementation would result in overall beneficial environmental effects. The results of the preliminary environmental analysis for the selected plans are presented in the Environmental Appendix. Additional environmental analyses will be completed as part of the Water Contracting EIS's.

The Level 4 plan could provide for a dependable supply of 10,000 acre-feet of water. The improved habitat could increase habitat quality, the number of nesting pairs of waterfowl, wading birds, and upland birds as indicated in Table IV J-6. The number of wildlife use days also could increase for this portion of the refuge, as presented in Table IV J-6.

E. SOCIAL ANALYSIS

The social consequences of constructing and operating the alternative plans would be positive due to the potential increase in public use. The local social environment is discussed in the Social Appendix.

F. POWER ANALYSIS

PG&E serves the Kesterson NWR under the PA-1 rate schedule for agricultural users. A facility must be an authorized function of the CVP to receive project-use power. The authority to deliver CVP power to the refuge is currently being examined and will be detailed in the Refuge Water Supply Planning Report. A more detailed discussion of project use power and wheeling agreements is provided in the Power Analysis section of Chapter IV B.

TABLE IV J-5

LISTED, PROPOSED, & CANDIDATE, THREATENED & ENDANGERED SPECIES

KESTERSON NWR

Listed Species

Mammals

San Joaquin kit fox, Vulpes macrotis mutica (E)

Birds

Bald eagle, Haliaeetus leucocephalus (E)

American peregrine falcon, Falco peregrine anatum (E)

Aleutian Canada Goose, Branta canadensis leucopareia (E)

Proposed Species

None

Candidate Species

Birds

Swainson's hawk, Buteo swainsoni (2)

White-faced ibis, Plegadis chihi (2)

Western snowy plover, Charadrius alexandrinus nivosus (2)

Tricolored blackbird, Agelaius tricolor (2)

Reptiles

Giant garter snake, Thamnophis couchi gigas (2)

California tiger salamander, Ambystoma tigrinum californiense (2)

Invertebrates

Molestan blister beetle, Lytta molesta (2)

Plants

Hispid bird's-beak, Cordylanthus mollis subsp. hispidus (2)

Delta coyote-thistle, Eryngium racemosum (1)

Bearded allocarya, Plagiobothrys hystriculus (2)

Valley spearscale, Atriplex patula subsp. spicata (2)

Source: USFWS, June 4, 1987

(E)--Endangered

(T)--Threatened

(CH)--Critical Habitat

(1)--Category 1: Taxa for which the Fish and Wildlife Service has sufficient biological information to support a proposal to list as endangered or threatened.

(2)--Category 2: Taxa for which existing information indicated may warrant listing, but for which substantial biological information to support a proposed rule is lacking.

TABLE IV J-6
WILDLIFE RECREATIONAL BENEFITS AND RESOURCE IMPACTS
KESTERSON NWR

Item	Water Delivery Levels			
	Level 1	Level 2	Level 3	Level 4
Habitat Acres				
Permanent Water	20	20	60	180
Seasonal Marsh	470	470	750	1240
Bird Use Days				
Ducks	2,383,000	2,383,000	3,600,000	4,460,000
Geese	6,900	6,900	11,010	13,500
Wading and Shorebirds	1,366,000	1,366,000	2,180,000	2,680,000
Endangered Species	2,010	2,010	3,210	3,920
Public Use Days				
Consumptive	2,800	2,800	3,200	3,900
Nonconsumptive	200	200	500	1,000
Annual Recreational Benefits	\$ 110,730	\$ 110,730	\$ 132,430	\$ 169,860

G. PERMITS

Construction activities would require several permits. Merced County would issue permits for wells and approvals to ensure that the existing drainage facilities would not be adversely effected. If water is transferred through the SLCC, or the GWD facilities, their approval is recommended. If water rights are to be obtained, the State Water Resources Control Board would be granting the permits. Stream Alteration Permits would be required from the DFG and an Army Corps of Engineers permit for construction activities in wetlands or riparian corridors.